

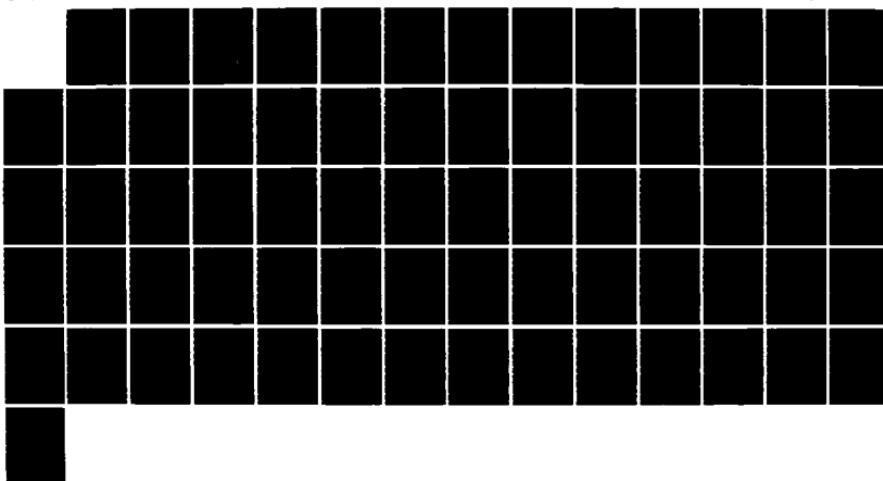
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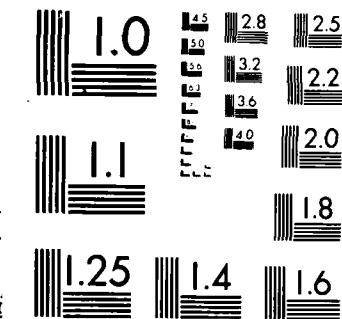
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A STUDY OF USER INVOLVEMENT IN THE
MILITARY CONSTRUCTION PROGRAM PROCESS
THESIS

Michael Stollbrink
Captain, USAF

AFIT/GEM/DEM/86S-27

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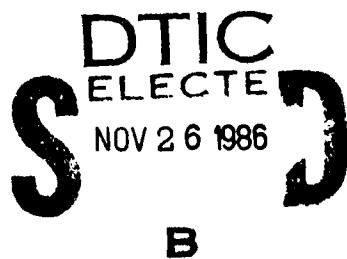
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A STUDY OF USER INVOLVEMENT IN THE
MILITARY CONSTRUCTION PROGRAM PROCESS

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Engineering Management

Michael Stollbrink, B.S.C.E.

Captain, USAF

September 1986

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Captain Michael Stollbrink

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Abstract

This thesis studies user involvement in the Military Construction Program (MCP) Facility Aquisition Process. Written due to a lack of information on the subject of user involvement, it is intended to measure how well the user understands his role in the MCP process and the actual level of user involvement in the MCP programming and design phases. The study also examines whether or not a relationship exists between level of user involvement and degree of change required on MCP projects.

The study surveyed users who had participated in the MCP process to measure their understanding of their role and level of involvement in the process. Research findings indicate that users have a degree of understanding of and involvement in the MCP process that falls somewhere between an adequate degree and a high degree. There were certain areas here a need for improved user understanding was indicated. The study found no relationship existed between level of user involvement in the MCP process and degree of change on MCP projects.

A STUDY OF USER INVOLVEMENT IN
THE MILITARY CONSTRUCTION PROGRAM PROCESS

I. Introduction

The Air Force often requests changes during the design and construction phases of facility projects. Changes are usually needed because the facility, as designed prior to the change, will not meet Air Force needs or because overlooked site problems exist. Changes create more work for the designer or construction, delay project completion, and cost the Air Force money. An article in the Proceedings of the American Society of Civil Engineers, Journal of the Construction Division, states in addressing this topic "Change orders can kill a project if they get out of control. This is either in design or construction" (9:439).

The Air Force programs and purchases facility design and construction through the Military Construction Program (MCP). The MCP process, described in more detail later, starts when a requirement for a facility is identified and ends with a completed facility that hopefully satisfied the requirement. The MCP process involves a programming phase, a design phase, and a construction phase. Changes may be required during any of these phases of the MCP process.

Changes during the programming phase usually do not pose major problems as they often involve changing the scope of the project. However, this could delay project approval and if the scope change is large and occurs after the project has

been approved it could delay or kill the project.

Changes during the design phase can cause more significant problems, especially if they require an increase in project scope and/or a major redesign effort. Changes during the construction phase are typically very expensive and should be avoided at all costs.

Changes during the design and/or construction phases can also cause costly time delays. Changes during the design phase can also result in possible loss of the project due to increased cost.

Special Problem

Changes required during the MCP process are a problem because they cost time and money. This study proposes that a basic reason for changes required in the MCP process is lack of user involvement. The user is the organization whose mission the proposed facility will support.

The basic hypothesis of this study is that there is a relation between level of user involvement in the MCP process and the degree of change (measured as a ratio of total cost of changes to initial approved project cost) required on MCP projects. The following hypotheses were developed in support of this basic hypothesis:

1. The user does not fully understand his role in the MCP programming and design phases.
2. The user does a poor job of identifying his functional requirements in the programming process.

3. The user is not adequately involved in the design review process and does not adequately review the design for functional requirements.

Research Questions

The following research questions were developed to test the hypotheses stated in the previous paragraph. Questions 1-3 measure the quality and degree of user involvement in the programming and design phases. Question 4 determines if a relationship exists between user involvement and the need for change in an MCP project.

1. How well did the user understand his role in the programming process and the overall purpose of the programming process?
2. How well did the user define his functional requirements to the Base Civil Engineer in the programming process?
3. To what degree was the user involved in the design review process?
4. Is there a relationship between changes required in a project and the overall level of involvement of the user in the programming and design process?

All survey items were statements about the user's role in the MCP programming and design phases. The respondents were asked to reply to each statement in terms of degree or level of understanding, involvement, or performance. A Likert scale with a range of 1 to 5 was used in the survey. The

numerical options were defined as follows:

1 = to a very low degree/not at all

2 = to a low degree

3 = to a moderate degree

4 = to a high degree

5 = to a very high degree

The degree of user involvement was measured by examining how well the user understood his role in the programming process, how much the user was involved in the programming process (and, to a lesser extent, the design process), and to what degree the user was able to identify his functional requirements to the Base Civil Engineer in the programming process.

Scope of the Research

The following describe the scope of the research:

1. The research covered a sample of projects drawn from Air Force MCP projects completed in the last two years.
2. Only projects in the Continental United States were considered.
3. No maintenance and/or repair projects were considered.
4. MCP projects in support of new weapons systems beddown were not included in the sample since the actual user for facilities in this class is often not involved in development of facility requirements.

Limitations of the Research

The research was limited by the following items:

1. The time delay since the project was programmed.

Since recently completed MCP projects were studied, three to five years have elapsed since project programming and design took place. Survey respondents might not accurately recall their involvement in the programming and design phases.

2. The method used to account for degree of change.

The data used to determine degree of change does not account separately for changes due to problems such as unexpected site conditions. Hence, there could be projects where the user did an outstanding job of identifying his requirements and yet there was still a high degree of change.

3. Limited representation of the user's input. Only one user representative was surveyed for each project. However, there could be projects on which several user representatives participated in the programming and design processes. The one individual surveyed may have no feel for the quality of the other user's input to the programming and design phases.

4. Potential for bias. The measures of user involvement were supplied strictly by the user and hence may be biased.

Background

The using organization's input is most critical during the programming phase of the MCP process. One of the primary responsibilities of the using agency in developing its input is to provide a complete functional description of the proposed facility to the Base Civil Engineer's project programmer. The project programmer then translates this information into functional facility requirements which are incorporated into the Project Book. The user's input to the Project Book is the major part of his involvement in the facility acquisition process.

During the design phase, an architect/engineer (A/E) firm will use the Project Book (which addresses many other areas in addition to the user's functional requirements) to design the new facility. The user's only involvement during the design phase is to review the proposed design at certain phases (usually 35% and 90%) to insure that the proposed design meets his organization's requirements. If user requirements were identified correctly in the Project Book and understood by the A/E, the user should have little involvement in the design phase beyond review of plans and specifications to see that they satisfy his needs. However, if user requirements were poorly identified in the Project Book, the user may discover during design review that the proposed facility does not meet his functional requirements and a contract change is necessary. These changes cost time and money and may also result in a sense of dissatisfaction on the part of the using organization.

The user has almost no role in the MCP construction phase, but should be kept informed on the progress of his new facility. An exception would be an addition to an existing facility where construction impacts the user's day-to-day operation. However, potential impacts should be addressed in the programming and design phases to preclude a change to the construction contract.

Identifying user requirements involves describing the function of the facility and the personnel, equipment, and activities that will characterize the facility (12:15). This information is used by the A/E as the basis for facility design. A more detailed discussion of the items a user needs to consider when identifying functional requirements is included in the literature review.

Methodology

The methodology used was to survey users from recently completed MCP projects to determine their overall level of involvement. This was accomplished with a 30-question survey with users being placed in one of five levels of involvement (from low to high). Degree of change for a project was measured on a scale of zero to one and computed as total cost of construction changes divided by the contract award cost. This data was provided by the Construction Division, Directorate of Engineering and Services at HQ USAF (AF/LEEC).

Data was analyzed by first matching the user involvement rating with the degree of change for each project. The average degree of change for each of the five different levels of user

involvement was then computed. Analysis of variance (ANOVA) was then used to see if there was significant difference between the average degree of change among any of the groups. ANOVA looks at the differences in the values for average degree of change for each of the groups and determines, using statistical methods, if this difference can be attributed to being assigned to a particular group.

The survey method was selected because it permitted investigation of the largest number of projects, thereby increasing the level of confidence in the findings. This method also has the least potential for introducing bias. Since the survey classified user involvement into one of the five groups, analysis of variance among the groups was the best statistical method to indicate a significant difference between the average degree of change for any two groups.

II. Literature Review

Introduction

The focus of this study was to examine the current MCP process and the user's role in that process and then to study user requirements and the things the user should be concerned with when developing his requirements. If it can be shown that the quality of the user's role has an impact on the overall cost of the project, improving user involvement in the MCP process would provide potential for significant cost savings to the Air Force. For example, a concerted project review effort by both designers and users across the entire spectrum - planning, design, and construction, helped improve on the construction of the Space Shuttle Assembly Building at Vandenburg AFB, CA. The effort reduced project cost from \$59 million to \$39 million (15:19). The Space Shuttle facility is just one of many construction programs with potential for significant savings.

The data base for this review included articles from both the military and the private sector. As most military construction is done by private sector organizations with the military serving as "owner", most principles are universally applicable. Owner refers to the agency that is contracting for the construction of a facility. User refers to the agency or agencies that will occupy the completed facility.

First, the process the Air Force currently uses to identify user requirements and get the user involved in the MCP

facility acquisition process was examined. Then the review considered methods to help insure that comprehensive user requirements are given to the facility designer.

Facility Acquisition through the Military Construction Program

The facility acquisition process begins when the using organization establishes a facility requirement. If the facility requirement has a construction cost of over \$200,000, AFR 86-1, Programming Civil Engineer Resources, requires that the acquisition be accomplished through the Military Construction Program (MCP) (6:3-4). There are three distinct phases in the MCP process - programming, design, and construction.

Programming. After determining that a facility is required, the host base begins the programming phase of the MCP process. It is the user's responsibility to provide a description of his functional facility needs to the Base Civil Engineer's project programmer. Often, the user is unaware of this responsibility. Therefore, the project programmer should actively solicit the information. Using this and other information, the base prepares a DD Form 1391, "Military Construction Project Data", which briefly describes the project, requirements, current situation, impact if not provided, and a cost estimate. Once completed, the DD Form 1391 is submitted to the major command (MAJCOM) for validation and support (2:14).

If the DD Form 1391 is validated by the MAJCOM, the host base prepares a project book for each facility. The project book is a document containing data, criteria, functional

requirements and costs to support programming and design of facility projects. The purpose of the project book is to provide all functional design criteria to be used in the MCP design process. A thorough project book considers all requirements. It increases the probability of getting the best possible facility at minimum cost and with the least amount of change (13:K-3).

The user plays an important role in the development of the project book. The user's input to the project book is critical because it is here that he must identify the functional requirements that will later form the basis of design. The user's input should include a complete functional description of the facility. If the user provides a quality description of his functional requirements for the project book, the rest of his involvement in the MCP process will be minimal. The Base Civil Engineer must insure that the project book includes a thorough description of the user's functional requirements. Functional requirements are discussed in the next section of this literature review.

The host base forwards project books to the MAJCOM for review and validation and the MAJCOM in turn forwards the project book to HQ USAF/LEE and the appropriate AFRCE for review by the Facility Panel (F-Panel). If the F-Panel validates the project, a Design Instruction (DI) is issued. The DI directs the responsible AFRCE to proceed with the design of the project to the 30% level and informs the MAJCOM and base of impending actions (2:14). For Fiscal Year '89 and thereafter,

project books are due to the responsible Air Force Regional Civil Engineer and the HQ USAF Directorate of Engineering and Services 30 days after the Design Instruction is issued (7:5).

Design. The DI issued by HQ USAF to the AFRCE marks the beginning of the design phase. After receiving the DI, the AFRCE forwards it and the project book to the design agent and directs the agent to begin design (2:15). Air Force Regulation 89-1 describes the selection of the Design Agent as follows:

Normally, either the Army Corps of Engineers (COE) or the Naval Facilities Engineering Command (NAVFAC) will serve as the design agent. However, with Office of Secretary of Defense approval, it may be an Air Force organization or any other Government organization that provides engineering design with in-house forces or through the procurement of A/E services, or both (5:4-1).

The Design Agent then proceeds with in-house design or selects an A/E firm to accomplish the design work. Normally, the A/E is authorized only to complete design to the 30% level. At that time, the design is submitted for the first of several thorough reviews (2:15).

At this point, the user should review the design to insure the proposed facility meets his functional requirements as described in the project book. The user should direct any questions on the 30% drawings and specifications to the Base Civil Engineer (BCE). The BCE should act as a user consultant and provide help in understanding the drawings and specifications. The user should not be concerned with technical

requirements during the design review; this is the responsibility of the design agent. Functional requirements are characteristics that the user needs in the facility and technical requirements involve the methods and physical techniques the designer uses to provide these characteristics. After the review is complete and comments are incorporated, the design is considered 35% complete.

If the project has been approved by Congress for inclusion in the Military Construction Program, the designer will be instructed to proceed to the 95% design level. If the project is not disapproved by Congress, but construction funds are not appropriated and the need for the project still exists, HQ USAF may authorize continuation of design if funds for A/E services are available. At 95% design, the design agent and the Air Force will again review the drawings and specifications. On projects with major changes made at the 35% design point, a review may also be held at 60% design. Here again, the user should become involved to insure that the proposed design meets his functional requirements. After incorporation of the review comments, the A/E submits the final project design. The A/E is usually retained on contract to correct design errors or to incorporate new requirements and user originated changes during construction. Projects disapproved by Congress must be reprogrammed for future budget cycles and design work is terminated (2:15-16).

Air Force Regulation 89-1 says the AFRCE may approve changes during the design review as long as the change will

not involve more than a 10% increase or decrease in project scope or more than a 20% increase in the project's programmed cost or increased cost of one million dollars, whichever is less. The regulation adds, "However, the AFRCE should strive to furnish a design which will provide a complete functional facility within the programmed scope and having an estimated contract cost not exceeding the target construction contract cost" (5:4-4). Although the AFRCE has limited authority to approve changes, they should be made only when necessary. A 29 Jan 1986 letter from the Air Force Vice Chief of Staff addresses Congressional concern over changes during the Military Construction Program process. The letter states that "only those changes absolutely necessary to meet the mission should be made after the concept stage (35% design)" (10:1).

Construction. The AFRCE must now wait for HQ USAF authorization to advertise for bids on the construction of the project. After receipt of authorization, the AFRCE notifies the construction agent who releases a request for bids. Within a specified time period, a contract is awarded. During construction, contract changes may be required because of design errors, unforeseen site conditions, changes in requirements, and/or development of new requirements. Since most changes affect construction time and cost, it is important to minimize change (2:16). Changes can be especially costly during the construction phase of a project.

The user should have very little involvement in the

construction phase since he should have already reviewed and approved the final design and identified any problems with the proposed facility. The user might become involved during the construction phase if new user requirements develop during the construction period or if problems with the facility design were not noted by the user until the construction phase.

User Involvement

During the project book development, the user's input is critical. It is here that the user tells the BCE his facility needs. The BCE then translates these needs into functional requirements for inclusion in the project book. If the user does an effective job of communicating his needs, there will be less potential for future contract changes.

According to Maj. Gen. Wright, USAF, Retired, one way to cut down on costs during the design is to keep things simple. Talking about the Space Shuttle Assembly Building, he states, "Throughout the design phase, we made a concerted effort to keep it simple, with an eye toward not only minimizing construction costs, but also keeping in mind long term operations and maintenance considerations" (15:19).

A U. S. Army Construction Engineering Research Laboratory (CERL) report, "Preparing and Communicating Habitability Design Information", touches on the importance of the user communicating his needs to the designer. In describing habitability, the report states:

Habitability is a concern for how functional a facility is to a user. Functional habitability information cannot be addressed as a separate chapter to the facility plans and specifications. Instead, it must be integrated into the plans and specifications since the functional quality of a facility is affected by virtually all of its components. This requires intense user involvement. On some projects, habitability may be a dominant concern, while for others it will be less important. Habitability aspects of a facility concern the health, safety, performance, morale, and security of its users and occupants (12:11).

The CERL report also describes the most useful type of habitability design information. The report says this information should reflect the needs of users, be organized by facility space type or work station characteristics, and it must state the personnel, equipment, and activities that will characterize the mission. In addition, the habitability information should generally describe how the various user functions in the facility will relate to each other. The report then states that "by accounting for quality of habitability design information, facilities which effectively support the mission and activities of occupants can be achieved and maintained" (12:15).

To help insure that design information is complete, the CERL report suggests that the design agent arrange for meetings and facility site visits. These meetings and site visits should always include the facility user. The report also suggests documenting these meetings and site visits. During meetings, the report recommends that the facility type, facility subsystems and characteristics, and any needs for special procedures be discussed. This is also the time to

discuss any constraints with which the designer must work. During site visits, health and safety features, security features, and factors affecting user morale and satisfaction should also be discussed (12:20-22).

User involvement in the construction planning and management areas can also be important. Perhaps the most critical item in this area is the constructability review, which should occur during the design phase. In an article on construction management, Brig. Gen. W. T. Meredith, USAF, Retired, describes the constructability review as a "major claims avoidance procedure in which the design and construction contract documents are examined for any inherent problems or preventable difficulties for the contractor" (4:372). Items which should be noted include a determination that an accurate and complete description of work is available, whether there are any restrictions to contractor access, whether adequate work areas and disposal sites are available, and the availability of utilities (4:372). Although most of these items are Civil Engineering responsibilities, the user is responsible for identifying to the BCE any unique operational or security requirements that might have an impact on construction.

An article on the Air Launched Cruise Missile beddown appearing in the Winter 1983 issue of Air Force Engineering and Services Quarterly demonstrates how costs can be saved and future changes prevented during the cosntructability review. Maintaining security during construction of a weapons

storage area was a requirement because the area would be operational while the contractor was working. This required the contractor to sequentially move fences during construction. The procedure went smoothly and did not compromise the security of the facility (1:29). The reason the above procedure went smoothly is that the user identified his security requirements in the programming phase, thus enabling the designer to incorporate these requirements into the facility project. However, if this requirement had not been previously identified, the contractor could have submitted a major claim for work stoppage and the additional work of having to move the fences. Problems related to poor constructability reviews not only result in often expensive changes to the contract, but also cause time delays.

In "Boosting Efficiency in Construction", Jeffrey G. Busley, President of the Contractor Consultants Corporation, mentions the importance of early identification of potential problems. He states:

By doing a good job of preplanning, many potential problems can be identified before they develop and solutions can be worked out so that, when the problems occur, a plan for reducing them or improving the situation can be initiated immediately instead of two or three months after the problem begins to affect field installation" (3:350).

Close monitoring of change orders by the AFRCE and the design agent can also reduce costs. In "Improving Construction Management through Communication", Irving Hamburger, an engineer with HQ USAF states:

Naturally, some provisions for change orders should be included in the contract. However, the owner should be made to realize the possible impact on both time and money of change orders before the contract is written; the fewer the change orders after contract award, the more cost effective it is for all concerned (8:355).

Although Hamburger's article deals with Air Force Operations and Maintenance facility projects, his basic ideas can also be applied to MCP projects. Change orders during the construction phase should occur only on those items which, if not changed, would prevent the facility from being functional (a mission change would be one example). Nice-to-have changes should be avoided at all costs. A 29 Jan 1986 letter from the Air Force Vice Chief of Staff emphasizes that the final concept design (35% stage) is the last chance for the user to make user requirements changes, except for necessary mission changes (10:1).

By doing a good job in identifying requirements in the programming phase, the user can prevent the need for user generated changes in the design and construction phases.

III. Methodology

The survey approach was used to collect data for this study. A survey was the most effective and efficient way of examining the quality of past user involvement in the MCP process. A survey using interval level scales was thought to provide a more objective and quantifiable measure of the user's involvement than data from an interview, a review of project files, or other approaches. Statistical analysis was used to examine the data obtained and determine the significance of any relationships found in the data.

Instrument

A survey was developed and administered to the using organization's project manager for each project in the sample population. The survey measured the user's understanding of the programming process, the degree to which the user used the programming process to identify functional requirements, and the degree to which the user was involved in the design review process. Questions utilized five-point ordinal level scales (with three being to a moderate degree) to determine degree of understanding/involvement in the various processes.

Sample/Population

The sampled population was the set of MCP projects completed in Fiscal Years (FYs) 1984 and 1985. Population elements were restricted to Air Force MCP projects in the

Continental United States (CONUS). MCP projects in support of new weapons systems were excluded.

Data Collection Plan

Surveys were sent to user representatives for each project in the sample. Survey replies were analyzed and classified as to overall quality of user input/user involvement. Classification was on a five-point scale with three being to a moderate degree.

Degree of change was measured on a scale of zero to one and computed as total cost of changes divided by the construction contract award cost. These figures were obtained from the Construction Division, Directorate of Engineering and Services at HQ USAF (AF/LEEC).

Statistical Tests

Data was analyzed by first matching the individual user input/involvement rating (on the one-to-five scale) with the degree of change for the respective project. The average degree of change for each of the five different levels was then computed. Analysis of variance techniques (ANOVA) were employed to see if there was significant difference among the average degree of change for any of the groups. Further analysis was accomplished by combining groups (for example, combining groups 1 and 2 - very low and low degree of user involvement) and comparing them to groups 4 and 5 (high and very high degree of user involvement).

Data from surveys were placed in a file on the Air Force Institute of Technology's Academic Support Computer (ASC). SPSS^X was employed to analyze the data. SPSS^X is a comprehensive system for managing, analyzing, and displaying data (14:iii). SPSS^X was chosen because it provided all statistical techniques necessary for analysis of the survey data and was readily available on the Academic Support Computer.

The overall degree of user involvement of each survey respondent was computed as the numerical average of all replies to those questions in the survey which used the five-point ordinal scale. Question #28, which utilized this scale, was not included since it asked the user how well he felt the finished facility satisfied his functional requirements, but was not related to the user's actual involvement in the programming and design phases.

The numerical average was rounded to the nearest integer to give an overall level of user involvement of either 1, 2, 3, 4, or 5 that corresponds to the 5 choices on the Likert scale used in the survey.

Frequency analysis of survey data was used to address research questions concerning the user's understanding of his role and his involvement in the MCP programming and design processes. SPSS^X ONEWAY was used to perform the analysis of variance calculations. This uses an F-statistic to determine if population means are different at a specified significance level (11:111).

Analysis/Justification of Methodology

The survey approach was chosen for several reasons. First, no data was readily available on level of user involvement in the Military Construction Program process. In addition, it would have been difficult to obtain a valid measure of user involvement from review of historical files. Thus, data could have been collected only using the survey or interview method. Cost and time constraints made the interview method an unattractive alternative. Further, the survey method allowed for collection of a larger amount of data than the interview method and had less potential for introducing bias.

Since there is no practical method of objectively measuring levels of user involvement (for example, by using data generated during the MCP process), the survey measured the user's perceived level of his involvement. The survey provided the user with descriptions of what his role in the MCP process should have been and then asked the user to what degree he met his role.

Almost all questions on the survey required responses on a five-point scale. This scale was used to measure the degree to which the user performed his prescribed role in various parts of the MCP process. Respondents were instructed to choose from the following replies:

- A. To A Very Low Degree/Not At All
- B. To A Low Degree
- C. To A Moderate Degree
- D. To A High Degree

E. To A Very High Degree

This scale implies a rank order of response alternatives in regard to level of user involvement. Alternative "A" in the scale represents a low level of user involvement/understanding and alternative "E" represents a very high level of user involvement/understanding. This scale was chosen for the ease of understanding by the respondent and because it provided a means of quantifying on an ordinal level the degree of user involvement.

Change data was provided by the Construction Division, Directorate of Engineering and Services at HQ USAF and consisted of the construction contract award cost and the total cost of all changes to the contract. Change data was collected in this manner because cost and time constraints did not permit review of project historical files to estimate the degree of change in the project. It was assumed that the cost of changes was directly proportional to the impact of changes in the project.

Degree of change for a project was measured on a scale of zero to one and computed as the ratio of total cost of construction changes to the contract award cost. This method was chosen because it made best use of the available change data and it took into account the size of a project when computing degree of change.

The sample of projects was randomly chosen from Air Force MCP projects completed in FY 84 and 85. This population was chosen because it represented the most recent data available.

By only considering projects completed in the last two years, the limitation caused by the time lag concerning the actual date of user involvement was minimized. Only projects in the Continental United States were considered since overseas bases experience a higher personnel turnover and a variety of programming methods due to host nation agreements. MCP projects in support of new weapons systems were excluded because requirements for these projects are not always developed or identified by the facility's using organization.

Analysis of Variance (ANOVA) was chosen to determine if user involvement had any effect on the degree of change in a project. This method was used to measure the dependency or influence of one variable on another. It was hypothesized that degree of change in a project was dependent on the level of user involvement and ANOVA was an obvious statistical method to test this hypothesis.

IV. Results

Introduction

This chapter will be in two parts. The first part will analyze survey responses to research questions 1 through 3, which concern the quality and degree of user involvement in the programming and design phases. The second part will address research question 4 and results from analysis of variance to determine if a relationship exists between changes in a project and level of user involvement.

Survey Response Analysis

A randomly selected group of 104 MCP projects completed in fiscal years 1984 and 1985 was chosen for this study. Surveys were sent to the using organization for each of these completed facilities. The sample contained various types of support, common-use, and operations facilities, but excluded projects in support of new weapon systems. Of the surveys mailed, 46 completed and six incomplete were returned. The six surveys returned blank were not completed because the user's representative who participated in the MCP process was no longer with the organization.

In addressing research questions, a mean score for survey questions supporting that research question was computed. This mean score was computed by assigning values to responses on a scale of 1 to 5 as described in the methodology. Since the sample size was greater than 30, the Central Limit Theorem

was invoked and the mean score used to make inferences about user involvement in the MCP process.

Research question 1 asked how well the user understood his role in the programming process and the overall purpose of the programming process. Survey questions 1 through 4 were related to these topics. The results are provided below.

Survey Question 1: The purpose of the project book is to provide all functional design criteria used in the Military Construction Program design process. Normally an architect-engineering firm will use the project book as the basis of facility design. To what degree were you aware that this was the purpose of the project book?

Table 4.1
Frequency Table for Survey Question 1

Response	Frequency	Relative Frequency
to a very low degree	9	21.4%
to a low degree	7	16.7%
to a moderate degree	8	19.0%
to a high degree	9	21.4%
to a very high degree	9	21.4%

This relatively even distribution shows that nearly half of the users were not ever moderately aware that the project book is the basis for facility design. 38.1% were aware of the purpose of the project book to a low degree or a very low degree.

Survey Question 2: One of the primary responsibilities of the using agency in developing its input to the project book is to provide a complete functional description of the proposed facility. The Base Civil Engineer then translates this information into functional facility requirements. To what degree were you aware that providing this functional description of the proposed facility was an important part of your input to the project book?

Table 4.2
Frequency Table for Survey Question 2

Response	Frequency	Relative Frequency
to a very low degree	9	19.6%
to a low degree	7	15.2%
to a moderate degree	11	23.9%
to a high degree	8	17.4%
to a very high degree	11	23.9%

Table 4.2 shows the frequency and relative frequency (percent of responses) for each of the available options for survey question 2.

User responses to question 2 indicate that they were slightly more aware that functional facility requirements were an important part of the project book as compared to their awareness of the purpose of the project book. 34.8% of users were aware to a low or very low degree that functional facility requirements were an important input, while nearly 24% were aware of this to a very high degree.

Survey Question 3: A good functional description of a facility would include an analysis of the mission the facility will support, definition of space needs, and defining any special characteristics of each space. To what degree were you aware that these were important items to be considered in your input to Civil Engineering?

Table 4.3
Frequency Table for Survey Question 3

Response	Frequency	Relative Frequency
to a very low degree	5	10.9%
to a low degree	4	8.7%
to a moderate degree	7	15.2%
to a high degree	18	39.1%
to a very high degree	12	26.1%

The distribution of responses depicted in Table 4.3 shows a good awareness of those items to consider when developing functional requirements. 65.2% of users surveyed were more than moderately aware of those items which are important to consider when developing functional requirements.

Survey Question 4: Considering the above information about the purpose of the project book and the user's input, to what overall degree did you understand your prescribed role and the purpose of the project book when you were actually developing your input to Civil Engineering?

Table 4.4
Frequency Table for Survey Question 4

Response	Frequency	Relative Frequency
to a very low degree	9	19.6%
to a low degree	7	15.2%
to a moderate degree	10	21.7%
to a high degree	11	23.9%
to a very high degree	9	19.6%

This relatively equal distribution of responses shown in Table 4.4 indicates that slightly more than half of the users surveyed had at least a moderate understanding of their overall role and the purpose of the project book. 34.8% were aware of their role and the purpose of the project book to a low degree or a very low degree.

The mean score for responses to the survey questions related to research question 1 was 3.22. This falls slightly above the "moderate degree" response on the scale. This means that, on the average, user understanding of the purpose of and the requirements for their input to the project book ranged somewhere between a moderate and a high degree. Based upon this mean value, the hypothesis that the user does not understand his role in the MCP programming process was rejected with a level of confidence of 95%. The confidence level of this rejection means simply that there remains a 5% chance that the hypothesis is being rejected when it was in fact

correct. It was assumed that a mean of 2.5 or less would indicate lack of understanding. The lower bound of the 95% confidence interval was greater than 2.5.

Research question 2 asked how well the user defined his functional requirements to the Base Civil Engineer in the programming process. Survey question 6-10 addressed the user's input to the project book concerning functional requirements. The results are provided below.

Survey Question 5: To what degree do you think the project book adequately described the functional requirements of your organization for this facility project?

Table 4.5
Frequency Table for Survey Question 5

Response	Frequency	Relative Frequency
to a very low degree	6	13.3%
to a low degree	6	13.3%
to a moderate degree	16	35.6%
to a high degree	13	28.9%
to a very high degree	4	8.9%

Table 4.5 shows that most users felt that the project book adequately described their organization's functional requirements to at least a moderate degree. 26.7% felt that the project book described their functional requirements to a low or very low degree. Those who felt this way about the project book may be users who are satisfied to be getting a new facility and felt it was not important for them to make

a strong effort in identifying functional requirements. Still, the mean score for responses to this question was 3.0, indicating that on the average users felt the project book adequately described their functional requirements to a moderate degree.

Survey Question 7: To what degree were specialized requirements or unusual technical requirements of your organization (for example, a computer room or unique communications or security requirements) identified in your input to Civil Engineering?

Table 4.6
Frequency Table for Survey Question 7

Response	Frequency	Relative Frequency
to a very low degree	4	8.9%
to a low degree	5	11.1%
to a moderate degree	10	22.2%
to a high degree	12	26.7%
to a very high degree	14	31.1%

The values for frequency and relative frequency in Table 4.6 indicate that most users considered themselves adept at identifying special requirements during the programming phase. 80% of users felt they had identified these requirements to a moderate or higher degree. 57.8% of the respondents felt they were able to identify these requirements to a high or very high degree. However, 20% of users indicating that they were able to identify their specialized requirements to a low degree or less suggest that an effort to educate users on this being an

important part of their input may be worthwhile. One of five users identifying specialized requirements to a low degree or less create a strong potential for changes or facilities which do not truly meet user requirements.

Survey Question 8: To what degree were facility space needs (i.e., relationships between spaces, etc.) defined in your input to Civil Engineering?

Table 4.7
Frequency Table for Survey Question 8

Response	Frequency	Relative Frequency
to a very low degree	6	13.0%
to a low degree	3	6.5%
to a moderate degree	12	26.1%
to a high degree	15	32.6%
to a very high degree	10	21.7%

Table 4.7 shows the frequency and relative frequency of user response to the available options for Question 8. As with specialized requirements, most users (80.5%) were unable to identify facility space needs to at least a moderate degree. Again, more than half (54.3%) of the users felt they had identified facility space needs to a high or very high degree. Still, an effort to increase user awareness of the need to consider facility space requirements could help eliminate responses at the low end of the scale and reduce potential for change or unsatisfactory facilities.

Survey Question 9: To what degree did your input to civil engineering consider the mission the proposed facility was to support, in terms of activities, personnel, and equipment?

Table 4.8
Frequency Table for Survey Question 9

Response	Frequency	Relative Frequency
to a very low degree	4	8.7%
to a low degree	2	4.3%
to a moderate degree	8	17.4%
to a high degree	21	15.7%
to a very high degree	11	23.9%

The responses shown in Table 4.8 indicate that only a small percentage (13%) of the users did not consider the mission a facility would support to at least a moderate degree when developing their input to civil engineering during the programming phase. Considerably more than half (69.6%) of users considered the mission to a high or very high degree when developing their input.

When compared to responses concerning specialized requirements and space needs, the replies to this question show that an organization's mission is generally given much stronger consideration. This area has less potential to cause problems because it is considered to a higher degree by users when they are developing project criteria.

Survey Question 10: To what degree were projected mission or organizational structure changes (looking five years ahead) considered when providing your input to the project book?

Table 4.9
Frequency Table for Survey Question 10

Response	Frequency	Relative Frequency
to a very low degree	8	17.4%
to a low degree	4	8.7%
to a moderate degree	13	28.3%
to a high degree	15	32.6%
to a very high degree	6	13.0%

As reflected in Table 4.9, 73.9% of users surveyed considered projected mission changes to at least a moderate degree when developing their input during the programming phase. However, 17.4% of those surveyed considered projected mission changes to a very low degree or not at all. If the user is overlooking projected mission changes, an effort to let the user know to consider these during the programming phase is in order. This is because the 26.1% of users who considered projected mission changes to a low degree or less create a potential for changes and/or facilities which do not fully meet user requirements.

The mean score for responses to survey questions related to research question 2 was 3.38. This means that on the average users were able to identify functional requirements to somewhere between a moderate degree and a high degree. The mean score for questions in support of research question 2 is slightly higher than the score for questions in support of research question 1. This indicates the user feels more adept at identifying functional requirements than he does at understanding his role in and the purpose of the MCP programming process. The results for the survey questions supporting research question 2 indicate that the hypothesis that the user does a poor job of identifying functional requirements during the programming process must be rejected. It is rejected with a confidence level of 95% based on the data. Again, it was assumed that a mean level of 2.5 or less would indicate lack of user involvement.

Research question 3 addressed the degree to which the user was involved in the design review process. Survey question 14 through 26 queried the user about his understanding of and involvement in the design review process. Choices for responses were identical to those listed in the previous tables in this chapter and a frequency analysis was done on the replies. Individual questions and raw data are not listed here but may be found in Appendices A and B. The following paragraphs are a summary of responses that supported research question 3.

Of users surveyed, 92.7% understood their role in the

design review process to a moderate degree or higher. Further, 83.4% felt that concerns identified during design reviews were considered by the Air Force project manager to at least a moderate degree. 92.7% of users were able to understand the 35% design drawings and specifications to a moderate degree or better.

79.5% of the respondents felt they were able to understand the 90% design drawings and specifications to a moderate degree or higher and 84.6% were able to determine to a moderate degree or higher that the design met functional requirements. 59.5% of users related their degree of involvement in the overall design review process as moderate or higher. However, 33.3% rated their degree of involvement in the overall design review process as a very low degree. It is possible that a high percentage expressed low involvement in the review process due to lack of participation in the 35% design review or because another individual from their organization participated.

The mean score for responses to the survey questions in support of research question 3 was 3.59. This indicates an average degree of involvement in the 90% design review process between a moderate degree and a high degree. No statement can be made about user involvement in the overall design review process due to lack of sufficient number of responses concerning user involvement in the 35% design review process.

Analysis of Variance Results

Research question 4 asked if there was a relationship between the degree of change in a project and the level of user involvement in that project. Analysis of variance was used to determine if such a relationship existed.

Surveys were analyzed individually using the procedure described in Chapter III so that an overall degree of user involvement could be assigned to each survey. This analysis resulted in assignment to one of five groups representing different levels of user involvement. Groups were defined as follows:

Group	Level of User Involvement
1	very low degree/not at all
2	a low degree
3	a moderate degree
4	a high degree
5	a very high degree

The degree of change for each project corresponding to each survey was then computed as discussed in Chapter III. The average degree of change for each of the five levels of user involvement was then computed. These computations yielded the following results.

Table 4.10

Data Used for Analysis of Variance

Group	# of projects in group	Average degree of change (%)
1	3	2.7
2	7	7.3
3	16	3.6
4	15	4.7
5	4	5.6

Analysis of variance (ANOVA) showed no significant relation between level of user involvement and average degree of change in a project. ANOVA was done on the above data and another set of data derived directly from the above in groups 1 and 2 were combined and groups 4 and 5 were combined. ANOVA begins with the hypothesis that the population means of each of the groups are equal. Neither ANOVA application produced a significant F probability that indicated a significant difference in the population means. The F probabilities for the tests were .7001 and .6078. If there were significant differences in the means the F probability would be small - at a 95% confidence level it would be less than .05. Therefore, the hypothesis that there was a relationship between level of user involvement and degree of change in an MCP project was not supported at the 95% confidence level.

Rejection of this hypothesis might seem to imply that the user's role in the programming and design review process is insignificant. It was apparent that this conclusion was unreasonable. Therefore, several other comparisons of the data were made. However, no significant results were found which further supported the rejection of the hypothesis or suggested an error in data or statistical testing. There are, however, numerous possible reasons why the data reflects no significant realtionship between the level of user involvement and the average degree of change in an MCP project. Several of these reasons will be discussed in Chapter V.

V. Discussion

Introduction

This chapter presents an analysis of the results of this study and some conclusions that may be inferred from the results. The reader should keep in mind the conclusions contained in this chapter are based on the perceptions of representatives of using organizations. Recommendations for further research are also proposed.

Analysis of Results

Research question 1 addressed how well the user understood his role in the programming process and how well he understood the purpose of that process. Respondents showed the highest degree of understanding in the area of their responsibility to provide functional requirements to the Base Civil Engineer during the programming process. Respondents showed lesser degrees of understanding concerning the importance of the project book, the purpose of the project book, and the fact that the project book will be used as the basis for facility design. It appears that users recognize those items which are essential in developing good functional facility requirements, but they do not recognize how important these items are to the project book. Increasing user awareness of the purpose and importance of the project book might enhance the quality of user inputs during the programming phase. Less effort is needed in the area of defining functional requirements since, as men-

tioned in the previous chapter, the user is better at identifying functional requirements than he is at understanding the purpose of the programming phase.

The user needs to understand the purpose of the programming phase and of the project book so that he will know what items are important and how much detail should be included when developing this input. If the user does not understand what should be provided and in what detail he may face problems during the design phase or get a facility which does not fully meet organizational requirements. The benefits of user understanding are less potential for problems later on in the MCP process and finished facilities which better meet user needs.

Research question 2 addressed to actual level of user involvement in the programming phase of the MCP process. Respondents showed high degrees of involvement in identifying unique or specialized requirements, identifying space needs, and in considering the mission the proposed facility will support. However, when asked how well the project book described functional requirements, respondents gave more replies toward the lower end of the scale compared to the degree of involvement mentioned above. One possible reason for this might be that the user felt civil engineering did not adequately or totally consider the user when developing the project book. Another possible reason is that the users felt requirements were being dictated by other agencies or higher headquarters which detracted from local user input. Still, 73.4% of

respondents felt that the project book adequately described functional requirements to a moderate degree or higher. Responses to questions concerning actual level of user involvement in the programming phase did not support the hypothesis that the user does a poor job of identifying his functional requirements in the programming phase. The mean score of questions concerning actual level of user involvement in the programming phase showed that on the average the user felt he was involved to a degree somewhere between a moderate degree and a high degree.

Research question 3 addressed user involvement in the design review process. Most respondents were able to understand their role and the design drawings and specifications to a moderate degree or higher. However, when questioned about involvement in the overall design review process there were more replies toward the lower end of the scale indicating less involvement in the entire process. One possible reason for this is that involvement in the design review process could have been shared by different representatives from the using organization. Another possible reason is that users were not included in the 35% design review. Of the 46 respondents 22 said they did not participate in the 35% design review.

The percentage of users who were able to understand the design drawings and specifications and review them for functional requirements to a moderate degree or higher does not support the hypothesis that the user does not adequately review facility design for functional requirements. Due to the

large number of respondents who did not participate in the 35% design review and the fact that the survey did not account for possible participation by someone else from the using organization, no statement can be made about user involvement in the overall design review process.

When asked open-ended questions about ways to improve the user's role in the MCP process, 7 of the 16 respondents suggested developing guidelines that would let the user know what his expected role was at various points in the programming and design phases. These comments could be related to patterns in the data showing that respondents were generally able to identify functional requirements to high degrees but unable to recognize their importance at various points in the MCP process.

The analysis of variance application showed no significant relation between levels of user involvement and degree of change in MCP projects. There are numerous possible reasons for this. One possibility is that when the user is not involved in the process there is less chance for user requested changes and more of a chance that the user will simply get a facility that does not fully satisfy his functional requirements. Many users may be satisfied with the facility they are getting because it is better than what they presently have. This attitude would inhibit the user from requesting changes late in the MCP process. Another possible reason is that degree of change depends predominantly on other factors such as unforeseen site conditions or design errors. Still another possible reason is opposition to user changes during the construction phase unless

they are absolutely mission related. Changes needed due to low level of user involvement might not be made because of the policy of the Air Force toward such user generated changes. However, there is usually no choice but to correct changes due to unforeseen site conditions or design errors.

Conclusions

The following conclusions were drawn from this study:

1. The user feels he is adequately involved in the programming process in identifying functional requirements and aware of those items which constitute functional requirements.
2. The user is less aware of the importance and purpose of the project book and functional requirements to the programming process and the overall MCP process.
3. Users feel capable in interpreting design drawings and specifications and are adequately involved in reviewing designs for functional requirements.
4. There is no relation between level of user involvement in the MCP process and degree of change on MCP projects. However, this may be in part due to the facts that there are other factors which can cause changes. Also, it must be noted that this study considered changes during the construction phase when there is strong opposition to most user change requests. In general, a high level of the correct type of user involvement should reduce the need for user generated changes and should result in a facility

which better satisfied the using organization's functional requirements.

Recommendations for Further Study

The following recommendations for further study are made as a result of this research.

1. An investigation into the utility of a User's Guide explaining the MCP process, the importance and purpose of the programming and design phases, the user's expected role, and things which are important for the user to consider at the various points in the process. This study has shown that the user is generally aware of what items are important in developing functional requirements but less aware of when these items should be input and what his expected role should be. This user's guide should include the following:
 - a. A general description of the MCP process and the purpose of the programming, design, and construction phases. A timeline with the expected lengths of these phases should also be included.
 - b. Definition of the roles of the user, the Base Civil Engineer, and the Design Agent. A detailed description of the user's role during each phase, what items he should be considering and reviewing during each phase, and who he should bring problems to should be included.
 - c. A detailed description of the project book

including its purpose, what it will be used for, and those items the user should consider when developing his input to the project book.

- d. A definition/description of functional requirements and a checklist the user can employ to ensure that he considers all of the important and applicable items when he is developing his functional requirements.
2. A study of MCP projects which have had changes to determine the major causes of these changes.
3. A study to determine if there is any relationship between level of user involvement in the MCP process and the degree to which completed MCP facilities satisfy user requirements.

Appendix A: Survey Instrument

SURVEY ON USER INVOLVEMENT IN THE MILITARY CONSTRUCTION PROGRAM PROGRAMMING AND DESIGN PROCESS

Survey Control Number 86-59

Instructions: Answer all items by circling the appropriate letter on the survey sheet. All scales are fivepoint and are broken down in the following manner:

- A. To A Very Low Degree/Not At All
- B. To A Low Degree
- C. To A Moderate Degree
- D. To A High Degree
- E. To A Very High Degree

Select only one response to each item and clearly erase any response you change. If for any item you do not find a response that fits your situation exactly, use the one that is closest to the way you feel. Please answer each item as honestly and frankly as possible.

Although your response will be related to your particular project, all responses will remain anonymous. All data in the final report will be presented in group form and no reference will be made to particular projects.

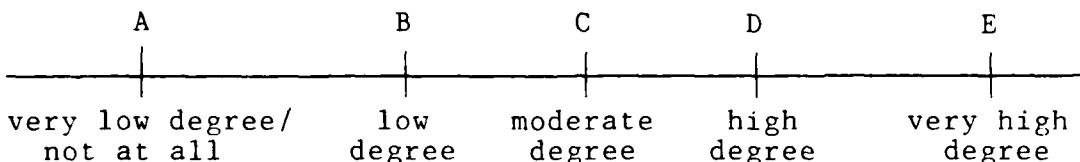
Section I: Programming Phase

The Project Book is a document which contains data, criteria, functional requirements, and cost information to support programming and design of Military Construction Program facility projects. The Project Book is developed by the Base Civil Engineer during the programming portion of the Military Construction Program process. The following questions concern the using organization's input to the Project Book. Functional requirements are statements about what is needed in a facility (numbers and kinds of people, what activities will be performed on the facility) to achieve a facility that meets the needs of the user. Technical requirements concern the methods and physical system that the designer employs to satisfy functional requirements.

1. The purpose of the Project Book is to provide all functional design criteria used in the Military Construction Program design process. Normally an architect-engineer firm will

use the Project Book as the basis of facility design. To what degree were you aware that this was the purpose of Project Book?

- A. To A Very Low Degree/Not At All
- B. To A Low Degree
- C. To A Moderate Degree
- D. To A High Degree
- E. To A Very High Degree



2. One of the primary responsibilities of the using agency in developing its input to the Project Book is to provide a complete functional description of the proposed facility. The Base Civil Engineer then translates this information into functional facility requirements. To what degree were you aware that providing this functional description of the proposed facility was an important part of your input to the Project Book?

A B C D E

3. A good functional description of a facility would include an analysis of the mission the facility will support, definition of space needs, and defining any special characteristics of each space. To what degree were you aware that these were important items to be considered in your input to Civil Engineering?

A B C D E

4. Considering the above information about the purpose of the Project Book and the user's input, to what overall degree did you understand your prescribed role and the purpose of Project Book when you were actually developing your input to Civil Engineering?

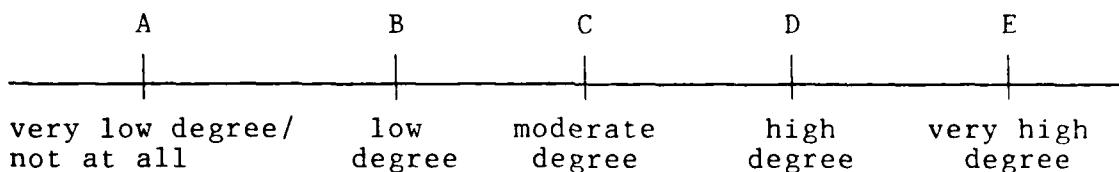
A B C D E

5. To what degree were you involved in identifying your organization's needs for inclusion in the Facility Project?

A B C D E

6. To what degree do you think the Project Book adequately described the functional requirements of your organization for this Facility Project?

A B C D E



7. To what degree were specialized requirements or unusual technical requirements of your organization (for example, a computer room or unique communications or security requirements) identified in your input to Civil Engineering?

A B C D E

8. To what degree were facility space needs (i.e., relationships between spaces, etc.) defined in your input to Civil Engineering?

A B C D E

9. To what degree did your input to Civil Engineering consider the mission the proposed facility was to support, in terms of activities, personnel, and equipment?

A B C D E

10. To what degree were projected mission or organizational structure changes (looking five years ahead) considered when providing your input to the Project Book?

A B C D E

11. To what degree did you feel you required guidance/information from Base Civil Engineering personnel in developing your input to the Project Book?

A B C D E

12. To what degree did Base Civil Engineering personnel provide guidance/information relating to your input to the Project Book?

A B C D E

13. Are there things you would suggest to improve the user's input to the Project Book? (List)

Section II: Design Phase

The pre-design conference is held after the architect-engineer is selected. One purpose of the conference is to clarify any questions the architect-engineer has concerning the Project Book or design of the Facility Project.

14. Did you attend the pre-design conference?

YES NO

(If the answer to Question 14 is NO, go to Question 17)

15. To what degree did the pre-design conference help to better establish user functional requirements?

A B C D E

16. From the user's viewpoint, are there any additional items that should be discussed at the pre-design conference to improve the architect-engineers understanding of the user's requirements. (List)

A review of the architect-engineer's design is held at 35% design completion. This review examines the architect-engineer's preliminary drawings and specifications to insure the architect-engineer is providing what the Air Force wants.

17. Did you participate in the 35% design review?

YES NO

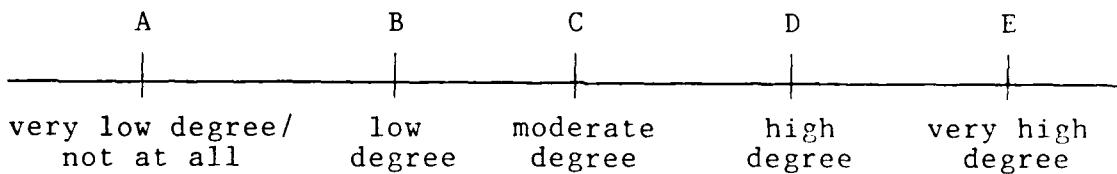
(If the answer to Question 17 is NO, go the Question 23)

18. The user role during the design review process is to verify that the proposed design meets user functional requirements. To what degree did you understand your role in the design review process?

A B C D E

19. To what degree did you consider user functional requirements in the 35% review process?

A B C D E



20. If you had any comments or concerns regarding functional requirements during the 35% review, to what degree were these concerns addressed by the Air Force project manager?

A B C D E

21. To what degree did you understand the 35% design drawings and specifications?

A B C D E

22. Do you have any suggestions for improving the 35% design review process to better insure the design will satisfy user requirements? (List)

As the facility design draws to a close, there is a 90% design review. The purpose of this review is, among other things, to insure that changes identified during earlier reviews have been incorporated into the design.

23. Did you participate in the 90% design review process?

YES NO

24. To what degree did you understand the 90% design drawings and specifications?

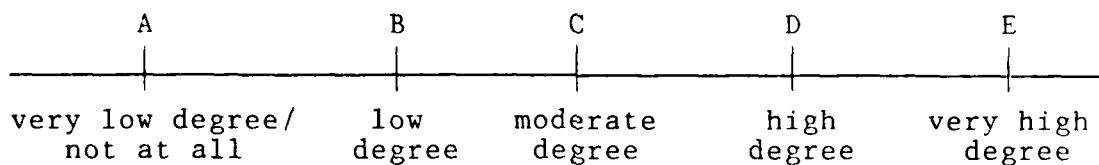
A B C D E

25. To what degree were you able to determine if the 90% design met user functional requirements?

A B C D E

26. Keeping in mind your role of insuring that proposed designs meet user functional requirements, how would you rate your degree of involvement in the overall design review process?

A B C D E



27. To what degree do you think you successfully filled the role of the user in the programming and design process?

A B C D E

28. To what degree do you think the finished facility satisfied user functional requirements?

A B C D E

29. What were the causes of changes in user requirements during the MCP process?

- A. Change in user equipment or facility function (mission change).
- B. Incomplete requirements during programming.
- C. Poorly defined requirements.
- D. Other
- E. There was no change in user requirements during the MCP process.

30. Were you the responsible individual during the programming and design phase?

- A. Yes
- B. Only during programming
- C. Only during design
- D. No

Appendix B: Raw Data

Survey Number	Response to Multiple Choice Survey Questions	Degree of Change
001	cddcdddccbbcbzbcddbdbccccad	.00
002	dcccddcdzzzbzzzzaddeeabd	.02
003	ddedcdcdccdbbzadedcadceeda	.02
004	aeeaacdddddabzbzzzzaddaaacdd	.10
005	zaaaaaaeeeaeabzbzzzzbeeaeabcd	.03
006	dcddcccccddcccdacbzazzacdcddcd	.00
007	aaaabcbbbadbbzbzzzzabcbaced	.00
008	dddddddeeddaddddaddddaded	.04
009	eeeeeeeeedceadzzzzzzzzza	-
010	aacbaccadbccbzbbbbbaaaadd	.01
011	bcccdddddabcbzbbbbzzzzed	.02
012	bcdddacccczazbzbzzzzazabd	.02
013	accaececdccdbzaccdcaccdccca	.04
014	deedeeeeeeacaeeddeaeeddedb	.00
015	bbccbffffbbzbzzzbzzaabbd	.15
016	dddcddcccdadacdbbaccdde	.12
017	aaaacbacaaabzbzzzbbaaaaced	.05
018	eeeeabaaaaeabbzzzbzzzaaaed	.05
019	bbbabcbcbbzazzccaccccb	.00
020	ccccddcdccacaddcdadccca	.00
021	zbcdedeedccadacdecadddd	.00
022	aaaaabcccdadaaabzzzbzzzbdb	.05
023	bccbaaaaaaabzbzzzbbaaaaed	.01
024	eeeeeddddeccacaedddadddzbdb	.09
025	eeeeccceccccbzbbzzbccabced	.00
026	cbbdceddcabzababcaccbcbbd	.04
027	cbdcdddddadeeeeeaedeecaa	.26

Survey Number	Response to Multiple Choice Survey Questions	Degree of Change
028	eeeeeeeeccaaeeeeedaaaaaaa	.19
029	cccdacedddcccbzbzzzaeaaaa	.01
030	ededezzccdddaddddeadddd	.03
031	acaaadcddcdabzbzazzadbaazd	.13
032	cddccbdcdbdcbzacccdadcccbc	.05
033	deeeedeeeedeadaeeddaedccaa	.02
034	eeeeeeeeaaeeeeaaeeeada	.00
035	cbbaaaaaaaaaabzbzzzaaddeaaba	.17
036	dcdcccccdbdadadceaddddba	.05
037	acdcdccccdbaaabbabbbaccch	.00
038	bdcccbcccccaabzzzaacccbcba	.02
039	eeeeedeeecbdaadeeadeeaa	.10
040	e eddddddcdadaddadddded	.01
041	zadbacddebdbadddbdbzzzzazd	.02
042	bddbddbdddadadeddaedddaa	.02
043	aaaaaaaaaabzbzzzbbaaadad	.02
044	dddadccddcaacadccdadddccba	.03
045	cbbbcccccdbbbzbzzzbcbcccd	.01
046	zeedebeeeeecbbzbzzzaeabcd	.06

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This thesis studies user involvement in the Military Construction Program (MCP) Facility Acquisition Process. Written due to a lack of information on the subject of user involvement, it is intended to measure how well the user understands his role in the MCP process and the actual level of user involvement in the MCP programming and design phases. The study also examines whether or not a relationship exists between level of user involvement and degree of change required on MCP projects.

The study surveyed users who had participated in the MCP process to measure their understanding of their role and level of involvement in the process. Research findings indicate that users have a degree of understanding of and involvement in the MCP process that falls somewhere between an adequate degree and a high degree. There were certain areas where a need for improved user understanding was indicated. The study found no relationship existed between level of user involvement in the MCP process and degree of change on MCP projects.

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A hand-drawn diagram on a white background. At the bottom left, there is a large circle. To its right is a tall, narrow triangle. Further to the right is a tall, narrow rectangle. The entire drawing is enclosed within a thick black rectangular border.